THE GRAIN-SIZE SEPARATION OF PRESOLAR COLLOIDAL DIAMONDS OF THE EFREMOVKA CHONDRITE. A. V. Fisenko[1], L. F. Semjonova[1], A. S. Aronis[2], V. F. Tatsy[3], Y. I. Mitrochin[3], and L. N. Bol'sheva[1], [1]V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry, [2]Institute of Solid State Physics, [3]Institute of Chemical Physics, RAS, Moscow, Chernogolovka.

At present the study of presolar diamonds is, on the whole, carried out for the bulk of their samples. However, the analysis of other interstellar relics (SiC, graphite) is mainly performed on their individual grains, which allows us to obtain various isotopic anomalies of the different elements and to study their origin. The separation of diamond by physical and/or chemical properties and the investigation of the resulting grains are the aims of this research.

Here we show the results of the separation of presolar diamond into various grain size fractions using ultracentrifugation. In order to determine the possibility of separating presolar nanometric-sized diamonds by sedimentation, we first separated synthetic diamond. For this purpose we used ultradispersion diamond (UDD), synthesized from the carbon of explosive by the detonation method. The mean size of the diamond grains, calculated according to their specific surface, was 2.6 nm. On the surface of the UDD, synthesized under analogous conditions, there are H, O, and N atoms. These atoms form a number of groups with surface C atoms, including COOH [1,2]. Therefore one can believe that, as used by us, synthetic diamond is similar to presolar diamond in grain size and surface composition. Before separation, the UDD was treated with $HClO_4$, 200°C, and dispersed in 4 M NH_3, producing a diamond colloid. The aliquot of this colloid was at first centrifuged for 2 h at 2000 g and then ultracentrifuged for 2 h at ~100,000 g. The mean size of diamond grains in sediment was calculated according to their specific surface and is equal to ~4.3 nm. We could not estimate the size of grains in supernatant due to the small amount.

Thus the model experiment has shown the possibility of separating nanometric diamonds with properties similar to those of presolar diamonds into grain size fractions.

Efremovka diamonds were used for presolar diamond separation. The chemical procedures used in this study were variants of those developed by Anders et al. [3]. The basic procedure was as follows: HF/HCl, $K_2Cr_2O_7$, $HClO_4$, and H_3PO_4. Special care was given to the safety of all diamond grains during their isolation. First, the coarse fraction (>0.1 µm) was removed. Then the <0.1-µm fraction was ultracentrifuged for 4 h at ~100,000 g. As a result, three diamond fractions were isolated. One of them is sediment. Two other fractions, designated EDS-1 and EDS-2, consist of the grains that remained in the supernatant: EDS-1 is the upper part of the supernatant and EDS-2 is the bottom. The sediment was resuspended in fresh 4 M NH_3 and then ultracentrifuged using the above conditions. Practically all the resuspended sediment was again settled out and the new sediment was designated EDS-3.

The analysis of EDS-2 and EDS-3 fractions by TEM (JEM-100CX, at 100 kV) shows the following: (1) these fractions consist in the main of diamond grains and (2) the size of the diamond grains in EDS-2 is equal to 1–2 nm, and in EDS-3 to 2-4 nm.

Thus, the performed experiment shows the possibility of using ultracentrifugation to separate presolar diamonds into various grain size fractions. Later on we plan to carry out an investigation of C, N, and noble gases in separated diamond fractions of the Efremovka chondrite.

Acknowledgments: This work was supported by the Russian Foundation of Basic Science grant 96-05-64546 for F.A.V., S.L.F., and B.L.N.

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